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F2A

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(54) A device with an angular contact bearing

(57) In a device with a double-row angular contact bearing the outer raceways are provided by elements (13, 14) which are axially displaceable in relation to each other. Prestressing or play of the bearing is determined by an eleastic ring (16) situated in a space delimited by opposing surfaces connected to the respective elements, whereby the axial bearing play decreases when the distance between the opposing surfaces increases.

FIG. 1.

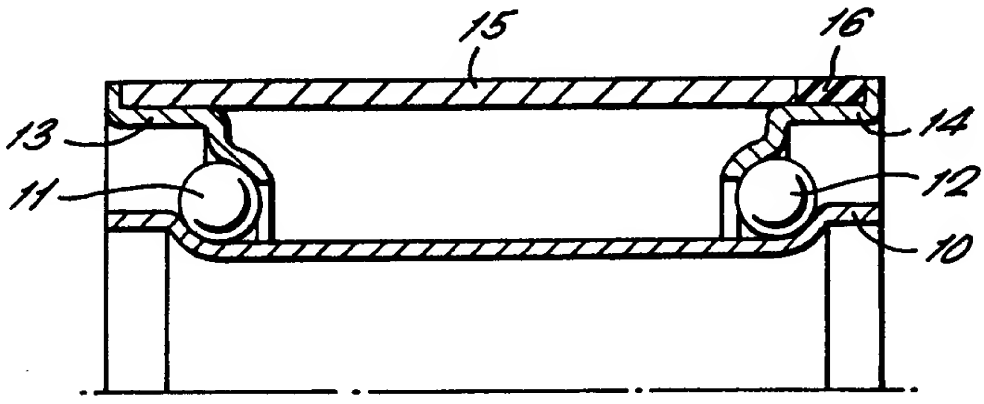

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FIG. 1.

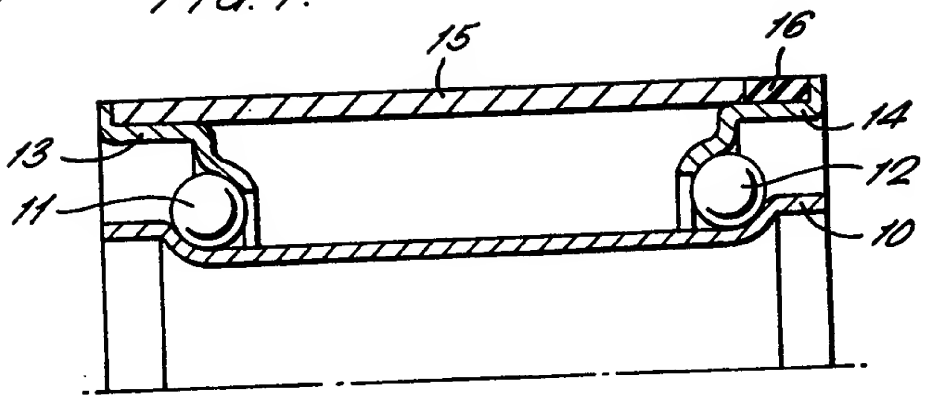


FIG. 2.

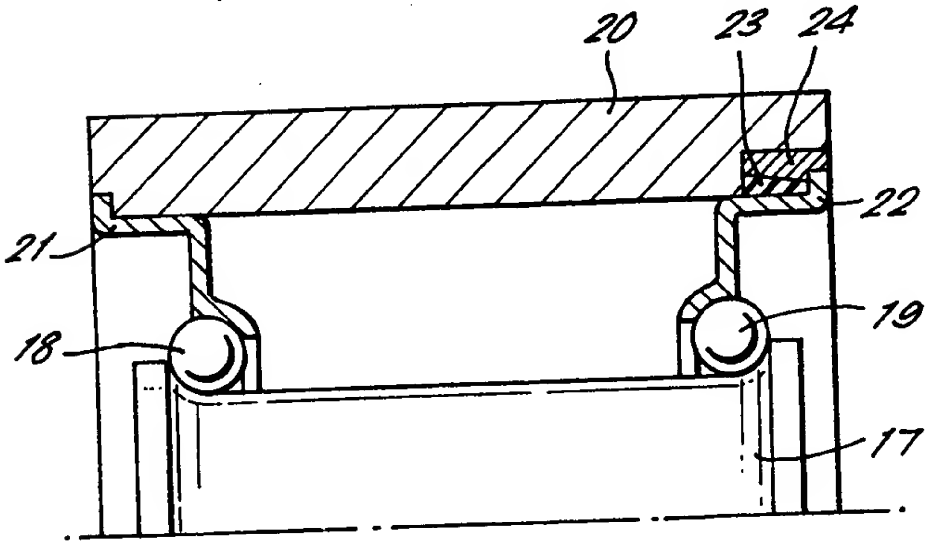


FIG. 3a.

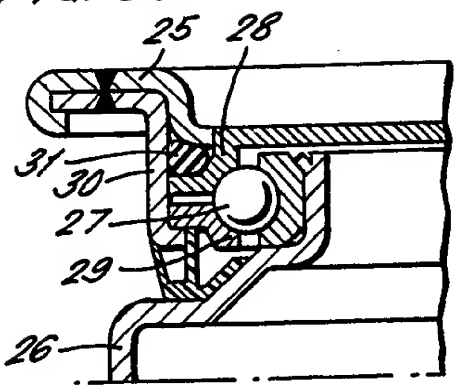


FIG. 3b.

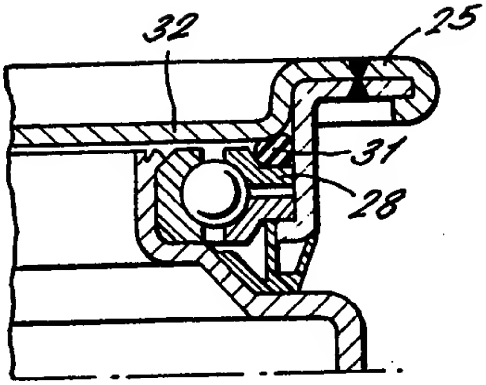


FIG. 4.

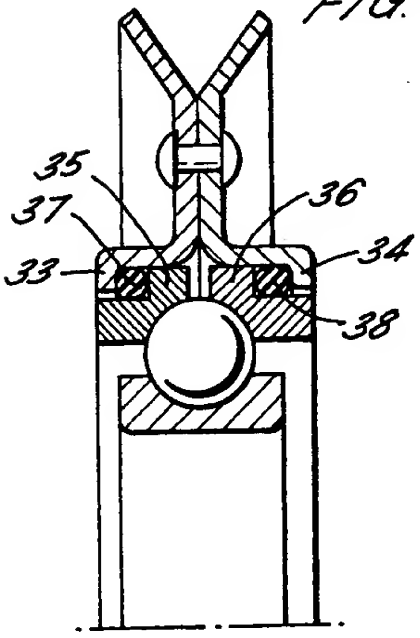


FIG. 5.

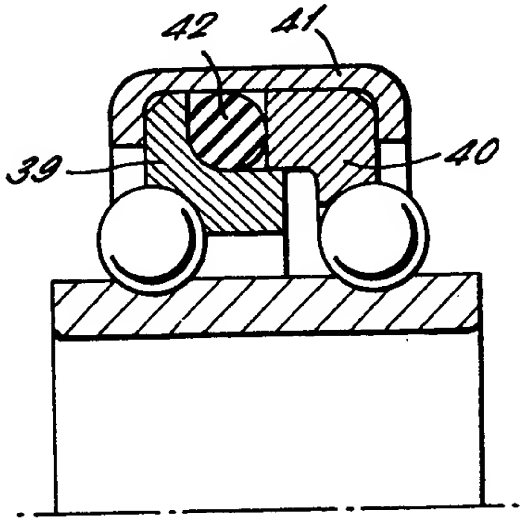
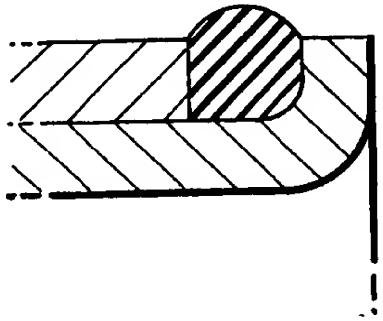


FIG. 6.



SPECIFICATION

A device with an angular contact bearing

The invention concerns a device with an angular contact bearing.

Such devices are used e.g. in various kinds of wheels and rollers. Common angular contact bearings, especially such with two rows of rolling bodies, are very stiff and capable of transmitting great tilting moments. Standard type bearings of this kind have an outer ring, an inner ring and two rows of balls and are comparatively expensive. In order to make assembly possible, they have a recess (ball filling groove) in the outer ring, which means that they can sustain great axial loads in one direction only. One advantage is that they are self-contained, which simplifies their handling.

In order to avoid the necessity of a filling groove in the outer ring and to make it possible to introduce a great number of balls, it is known to make the bearing with a split inner ring. Such a bearing is either not self-contained or provided with a sleeve or other connecting member for the inner ring. This last mentioned design, as does the use of two inner rings which contact each other directly, involves complicated and expensive measures and the preload or play of the bearing cannot be predicted with any precision.

The invention provides a device with an angular contact bearing comprising at least one row of rolling bodies and outer and inner raceways for angular contact with the rolling bodies, the outer or the inner raceway being divided into two elements and the raceway of one element having a contact angle opposite to the contact angle of the raceway of the other element, the elements being axially displaceable in relation to each other, an elastically deformable member being arranged to be squeezed between two surfaces connected directly or indirectly each to one of the respective elements, the surfaces being so arranged that the axial bearing play decreases when the distance between the surface increases and the member being elastically deformed by pressure against the surfaces when no bearing play exists, wherein the elastically deformable member is mainly incompressible and enclosed in a closed space which it completely fills when the device is assembled and mounted in or on a bearing seat.

The bearing can be assembled and filled with a great number of rolling bodies without being provided with filling openings, can be given a desired preload in a simple manner during mounting, and is very stiff after being mounted, so that it can take up heavy loads without being deformed appreciably.

The elastically deformable member is of a material which is substantially or practically incompressible, that is forces in the order of 10kN or more are required to effect a change in volume.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which Figures 1 to 5 show longitudinal sections of bearing devices according to various embodiments of the invention and Figure 6 shows an enlarged portion of a device.

The device shown in Figure 1 comprises an inner race ring 10; two rows of balls 11 and 12; two outer race rings 13 and 14 with cylindrical outer surfaces and radially outwardly extending flanges at their ends; an outer sleeve 15 whose inner diameter is equal to the diameter of the outer cylindrical surfaces of the outer race rings 13 and 14 and whose outer diameter is equal to the outer diameter of the flanges; and an elastically deformable member 16 in the shape of a ring, e.g. an O-ring of rubber, with an inner diameter which, in the relaxed state of the ring,is smaller than the diameter of the outer surface of the outer ring 14. Each of the outer rings 13,14 has an outer raceway for the balls in each row. The outer race ring 13 is fixed to the outer sleeve 15, whereas the outer race ring 14 is displaceable in the bore of the outer sleeve. Thus, the outer race rings 13 and 14 are displaceable in relation to each other parallel to the bearing axis so that adjustment of the bearing play or pre-stressing of the bearing is possible. The rubber ring 16 completely fills a space which is limited, in the axial direction of the bearing, by surfaces directed mainly perpendicular to the bearing axis, one of which is provided by the outer sleeve 15 and the other of which is provided by the outer race ring 14. One surface is one of the end surfaces of the sleeve 15, and the other surface is the inner surface of the radial flange of the outer race ring 14, and the surfaces are so arranged that the axial bearing play decreases when the distance between the surfaces increases.

Thereby a light prestressing of the bearing is obtained if the rubber ring 16 is elastically axially compressed between the said surfaces, so that the outer rings 13 and 14 are pressed away from each other by the spring force of the ring 16.

During assembly of the bearing, the outer ring 14 can be pushed into the sleeve 15 so that the rows of balls can be introduced without difficulty, due to the fact that the outer sleeve is shorter than the greatest possible distance between the flanges (which exists when there is no play in the bearing). When the balls and, if desired a cage are mounted, the ring 14 is pushed outwards until all play is eliminated, thereby forming a space between one of the end surfaces of the sleeve 15 and the inside of the flange of the race ring 14. The resilient ring 16 is radially outwardly expanded and moved over the flange of the outer ring 14 and then released

to enter the space. Because the inner diameter of the relaxed ring 16 is smaller than the diameter of the bottom of the space, the ring will be so stressed that the space is completely filled by the resilient material. After assembly, the outer diameters of the flanges, the outer sleeve 15 and the ring 16 should preferably be equal, so that the device has a mainly continuous outer cylindrical surface. The device is thereby suitable for being inserted into a cylindrical bearing seat, e.g. a hub. The ring 16 may possibly be so big that some of its material protrudes radially outside of the sleeve 15 and the flanges when the ring is mounted, as shown in Figure 6. The protruding material can be cut off by e.g. a tool with a circular edge. If play is desired in the bearing, the race rings 13 and 14 may be pressed towards each other until the desired play is obtained. This causes the ring 16 to expand outwards and a greater amount of material can be cut off.

When the complete bearing unit is mounted in its seat, the ring 16 is completely enclosed in a closed space and cannot be compressed. Therefore, the bearing keeps the prestress which is brought about during assembly. In a test made on a bearing with an outer diameter of 42 mm and a resilient member in the shape of a normal O-ring arranged to completely fill up a closed space as described, the bearing was loaded axially by a force of 10 000 N, and a relative displacement of the outer rings of less than 0,01 mm was measured.

Figure 2 shows an arrangement with a roller which has a ball bearing in its hub. In a manner corresponding to that shown in Figure 1, there is one inner race ring 17 and two rows of balls 18 and 19. A roller 20, e.g. a truck wheel, has a bore which contains two outer bearing race rings 21 and 22. Race ring 22 is displaceable axially in the bore of the roller 20 and the race ring 21 is fixed to the roller. A resilient ring 23 is arranged in an annular recess in the roller 20, which recess extends around a cylindrical portion of the outer race ring 22. The ring 23 is situated between an end surface of the roller 20 and a flange on the bearing outer race ring 22. A second ring 24, which can be a slotted steel ring or a closed plastics ring, is arranged around the ring 23 and fills the rest of the recess in the roller 20. The ring 24 has a tapered portion which is squeezed against the elastic ring 23, and an abutment which is snapped behind the flange of the bearing outer race ring 22. When the bearing is assembled, the race ring 22 is pushed completely into the recess of the roller 20, so that the balls can be introduced between their respective raceways. Thereafter the ring 22 is moved outwards into contact with the respective rows of balls, and then the resilient ring 23 is placed in the recess in the roller 20. Then the ring 24 is pressed into the recess so that the recess is completely filled.

Figures 3a and 3b show two different embodiments of a castor wheel bearing arrangement. The device comprises a plate 25 adapted for connection to e.g. a piece of furniture or a transport carriage, and a fork 26 which straddles a wheel, not shown. The fork is freely rotatable in relation to the plate 25 by being suspended by a ball bearing 27. The outer ring of the ball bearing consists of two parts 28 and 29, of which one part 29 is fixed in a housing 30 fixed to the plate 25 and the other part 28 is axially displaceable in the housing. An elastic ring 31 is squeezed between a flange on the outer ring part 28 and a confronting surface on the plate 25, whereby the ring 31 presses the ring part 28 axially against the balls in the bearing. According to Figure 3a, the ring part 28 is shaped as a cup arranged in a recess in the plate 25, whereby the ring part can be displaced in the recess. The elastic ring 31 is enclosed in a closed space so that it can be deformed and completely fill the space and give a rigid bearing arrangement. If the device is not subjected to heavy loads, the ring part 28 can be shaped as in Figure 3b, whereby a slot is formed between the ring part and a bottom part 32 of the plate 25. If the squeezing force on the elastic ring is moderate, there will be no problem of the ring 31 creeping out through the slot.

Figure 4 shows an embodiment of the invention in the shape of a belt pulley with a bearing. A cylindrical hub of the pulley surrounds the bearing and is provided with inwardly directed flanges 33 and 34, which together with outwardly directed flanges 35 and 36 on discrete parts of an outer race ring delimit two spaces for rubber rings 37 and 38. The outer ring parts are displaceable axially in the hub and are urged against the rolling element of the bearing by the rubber rings 37 and 38.

Figure 5 shows a two-row angular contact ball bearing with an outer ring in two parts 39 and 40, part 39 being telescopically displaceable in part 40 and in a surrounding sleeve 41. An elastic ring 42 is arranged in a closed space delimited by the sleeve 41 and the outer ring parts 39 and 40 and urges the latter each against a respective row of rolling bodies.

Embodiments of the invention other than those described above are possible within the scope of the claims. For example, the outer sleeve 15 and the outer race ring 13 (Figure 1) can be made in one piece. The race rings 13 and 14 as well as 21 and 22 of Figures 1 and 2 respectively, are preferably identical but may also have different shapes. Seals can be arranged between portions of the outer and the inner race rings which face each other. The inner raceways may possibly be arranged

on separate rings, which are mutually displaceable and co-operate with an elastic ring, whereby the outer raceways may be provided on a single element. The inner or outer raceways can be arranged directly in the associated element, such as a journal or a hub, instead of in separate bearing rings. The bearing may comprise e.g. tapered rollers instead of balls as rolling bodies.

CLAIMS

1. A device with an angular contact bearing comprising at least one row of rolling bodies and outer and inner raceways for angular contact with the rolling bodies, the outer or the inner raceway being divided into two elements and the raceway of one element having a contact angle opposite to the contact angle of the raceway of the other element, the elements being axially displaceable in relation to each other, an elastically deformable member being arranged to be squeezed between two surfaces connected directly or indirectly each to one of the respective elements, the surfaces being so arranged that the axial bearing play decreases when the distance between the surfaces increases and the member being elastically deformed by pressure against the surfaces when no bearing play exists, wherein the elastically deformable member is mainly incompressible and enclosed in a closed space which it completely fills when the device is assembled and mounted in or on a bearing seat.

2. An angular contact rolling bearing or a device including an angular contact rolling bearing, the bearing comprising at least one row of rolling bodies, one or more radially outer raceway surfaces and one or more radially inner raceway surfaces, two elements together providing the radially outer or inner raceway surface or surfaces, each element providing at least a part of a raceway surface, the angle of contact between one element and one of the rolling bodies having an axial component in one direction and the angle of contact between the other element and one of the rolling bodies having an axial component in the opposite direction; the two elements being axially movable with respect to each other, and one or more elastically deformable members acting directly or indirectly on the elements to reduce or eliminate play in the bearing, the more the or each member expands axially the less play there is and when there is no play the or each member is still axially loaded, wherein when the device is assembled or the bearing is mounted in a device, the or each elastically deformable member is positioned in a closed space and substantially fills the space so limiting axial compression of the or each elastically deformable member.

3. A device with an angular contact bearing substantially as herein described with reference to and as shown in Figure 1 or with reference to and as shown in Figure 2 or with reference to and as shown in Figure 3 or with reference to and as shown in Figure 4 or with reference to and as shown in Figure 5 of the accompanying drawings.

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